



Idaho National Laboratory

Patents 2005

Peter Kong and *Brent Detering* collaborated on an invention titled **Plasma Reforming and Partial Oxidation of Hydrocarbon Fuel Vapor to Produce Synthesis Gas and/or Hydrogen Gas**. This invention achieves a method and system for treating vapors from fuels such as gasoline or diesel in an internal combustion engine to form hydrogen gas or synthesis gas to enhance the engine performance.

Kevin Kostelnik, *Hideki Kawamura*, *John Richardson* and *Masaru Noda* were named on three patents this year. The inventions were for an **Advanced Containment System** for containing buried waste and associated leachate. The system involves a series of interlocked, parallel casing sections that are installed beneath or alongside the zone of interest and can present impermeable or semi-permeable barriers. The system also allows for the installation of sensors so that the performance of the barrier can be monitored remotely following installation.

A patent titled **Automatically Scramming Nuclear Reactor System** is credited to *Abderrafi Ougouag*, *Richard Schultz* and *William Terry* for an automatic shutdown system in gas-cooled nuclear reactors. The shutdown control rods are suspended by coolant flow pressure in normal operation, and when coolant flow stops, the shutdown control rods fall into place by gravity.

Brady Lee and *Kirk Dooley* collaborated on an invention titled **Well Constructions with Inhibited Microbial Growth and Methods of Antimicrobial Treatment in Wells**, designed to inhibit microbial growth in a well and prevent bio-fouling and plugging of wells.

INL patented a technology titled **Method for Chromium Analysis and Speciation**, which provides a method for detecting chromium in an aqueous sample. This invention is credited to *Abigail Aiken*, *Brent Peyton*, *James Petersen* and *William Apel*.

A **Thermal Synthesis Apparatus and Process** is credited to *Brent Detering* and *James Fincke*, which develops an apparatus for thermal conversion. It includes an insulated reactor chamber having a high temperature heater, such as a plasma torch at its inlet end and, optionally, a restrictive convergent-divergent nozzle at its outlet end.

Jill Scott and *Paul Tremblay* were named on a patent for a **Laser Device** beam manipulation mechanism, which comprises a wavelength independent virtual source providing sub-micron positioning resolution. This device accurately delivers laser beams in the same location, which is due in part to the use of Lenz's Law to stabilize the sample in the high magnetic field.

A patent is credited to *David Everett*, *Don Clark*, *Eugene Erickson*, and *William Casper*, for their collaboration on a technology titled **Visual Probes and Methods for Placing Visual Probes into Subsurface Areas**. The visual probe is made of polycarbonate tubing – a clear glass like material, through which a miniature video camera is lowered to visually examine environmental conditions in and around a waste disposal area.

Kevin Gering was the sole inventor on a system titled **Photoreactor with Self-contained Photocatalyst Recapture**. The system is for the continuous use and recapture of a catalyst in liquid, comprising a generally vertical reactor having a reaction zone with generally downwardly flowing liquid, and a catalyst recovery chamber adjacent the reaction zone containing a catalyst consisting of buoyant particles.

Kenneth Telschow and *Vance Deason* were named on a two patents this year – one titled **Method and Apparatus for Acoustic Imaging of Objects in Water** is a method, system and underwater camera for acoustic imaging of objects in water or other liquids.

The second patent, **Inspection System Calibration Methods**, provides a method for providing absolute calibration factors for acoustic measurements, particularly for ultrasonic imaging of materials in combination with the INL acoustic imaging microscope and laser ultrasonic camera.

Reed Hoskinson, and a team of Temple University researchers collaborated to develop a system and method which discovers knowledge from within spatial data using spatial data mining algorithms. This patented technology is titled **Systems and Methods for Knowledge Discovery in Spatial Data**. It smoothes and cleans the data and applies classification algorithms to the known data, enhancing the prediction of values between the known points. One application of this methodology was to develop site-specific recommendations as to how to optimize a treatment for a spatial environment such as a variable-rate fertilizer recipe for an agricultural field.

Phillip West was the sole inventor on a **Method and Apparatus for Coupling Seismic Sensors to a Borehole Wall** suitable for coupling seismic or other downhole sensors to a borehole wall in high temperature and pressure environments. The pump includes a magnetic drive motor configured with a rotor assembly to be exposed to borehole fluid pressure including a rotatable armature for driving an impeller and an associated coil under control of electronics isolated from borehole pressure.

A technology titled **Network and Topology for Identifying, Locating and Quantifying Physical Phenomena, Systems and Methods for Employing Same** received a patent this year. *John Richardson*, *Karen Moore* and *Robert Carrington* collaborated to develop a method and system for detecting, locating and quantifying physical phenomena such as a strain or a deformation in a structure.

This patent issued to INL involves a nonthermal plasma reactor for reactive co-conversion of heavy hydrocarbons and hydrocarbon gases to light liquids. The technology includes a dielectric barrier discharge plasma cell having a pair of electrodes separated by a dielectric material and passageway. The patent titled **Nonthermal Plasma Systems and Methods for Natural Gas and Heavy Hydrocarbon Co-Conversion** was developed by to *Peter Kong*, *Lee Nelson* and *Brent Detering*.

During fiscal year 2005, three patents were granted for technologies relating to liquefied natural gas. *Dennis Bingham*, *Michael Clark*, *Bruce Wilding* and *Gary Palmer* were named on one of the patents titled **Method and Apparatus for Dispensing Compressed Natural Gas and Liquefied Natural Gas to Natural Gas Powered Vehicles**, which describes a low-cost fueling facility capable of dispensing liquid natural gas, compressed natural gas or both on-demand.

Under a group effort, *Bruce Wilding*, *Dennis Bingham*, *Michael McKellar*, *Terry Turner*, *Kevin Raterman*, *Gary Palmer*, *Kerry Klingler* and *John Vranicar* developed a second technology titled **Apparatus for the Liquefaction of Natural Gas and Methods Relating to the Same** which is a small scale plant designed to produce liquefied natural gas from existing natural gas transmission and distribution infrastructures.

Dennis Bingham was the sole inventor named on the development of the third patented technology titled **Method and Apparatus for Pressurizing a Liquefied Gas**. This particular method transfers heat energy from a portion of a liquefied gas in contact with a thermoelectric cooling surface to another portion of the liquefied gas in contact with the thermoelectric heating surface and converts some of the liquefied gas to a vapor state at an elevated pressure and at greater efficiency than other tank pressurization methods.

David Everett, Don Clark, Eugene Erickson, James Sisson, Joel Hubbell, and William Casper, received two patents during the fiscal year 2005. Their collaboration resulted in a **Lysimeter Methods and Apparatus**. Once inserted into the ground, the INL-developed suction lysimeter probe remotely draws soil water samples into the probe through its designated porous section. Water samples are collected in saturated or unsaturated conditions for chemical analysis and pressurized transfer lines remotely move water samples from the probe to a sample retrieval system on the land surface.

Daniel Ginosar and *Robert Fox* were named on a patent issued to INL for a process that produces alkyl esters useful in biofuels and lubricants. The technology titled **Process for Producing Biodiesel, Lubricants, and Fuel and Lubricant Additives in a Critical Fluid Medium** significantly reduces the cost of producing additives or alternatives to automotive fuels and lubricants utilizing inexpensive glyceride or free fatty acid-containing substances, such as animal fats, vegetable oils, rendered fats and restaurant grease.

A **Method for Reactivating a Solid Catalyst used in Alkylation Reactions** was developed by *Daniel Ginosar, David Thompson, Kyle Burch, David Zalewski* and *Robert Fox*. This technology allows the sustainable regeneration of solid acid alkylation catalysts, increasing catalyst longevity by more than 7,000% and offers significant promise in the potential elimination of toxic and environmentally destructive hydrofluoric and sulfuric acids used in the manufacture of motor fuel alkylate.

INL was granted a patent on a technology titled **In Situ Retrieval of Contaminants or Other Substances Using a Barrier System and Leaching Solutions and Components, Processes and Methods Relating Thereto**. *John Richardson, John Dick, Paul Sloan, Reva Nickelson* and *Stephanie Walsh* collaborated on developing the process and method relating to treating and retrieving desired substances from a zone of interest using subterranean collection and containment barriers.

Joel Hubbell and *James Sisson* developed a design for a drive probe tensiometer that is placed in the subsurface using the direct push technology. This invention titled **Tensiometer, Drive Probe for use with Environmental Testing Equipment, and Methods of Inserting Environmental Testing Equipment into a Sample** describes a multi-purpose environmental drive probe that can be used to collect moisture samples or moisture data from the subsurface.

A patent titled **Systems and Methods for Coating Conduit Interior Surfaces Utilizing a Thermal Spray Gun with Extension Arm** is credited to *Karen Moore* and *Raymond Zatorski*. This technology applies a coating to an interior surface of a conduit and a spray gun configured to apply a coating is attached to an extension arm that may be inserted into the bore of a pipe. The spray gun may be a thermal spray gun adapted to apply a powder coating. The extension arm and the spray gun may be cooled to maintain a consistent temperature in the system, allowing for a more consistent coating.

A composite neutron absorbing coating technology was developed at the INL which applies a substrate surface and includes a neutron absorbing layer overlying at least a portion of the substrate surface, and a corrosion resistant top coat layer overlying at least a portion of the neutron absorbing layer. This patent titled **Composite Neutron Absorbing Coatings for Nuclear Criticality Control** was developed by *Ronald Mizia, David Swank* and *Richard Wright*.

Peter Kong was the sole inventor on a patent titled **Cermet Materials, Self-Cleaning Cermet Filters, Apparatus and Systems Employing the Same**. This technology may be used in filtering particulate and destroying gaseous pollutants from internal combustion engines having intermetallic and ceramic phases formed by a combustion synthesis method.

Ann Marie Phillips, Bradley Gardner, Gregory Lancaster, Judy Partin, Kevin Kostelnik, and Catherine Pfeifer collaborated on developing a system titled **Sensor System for Buried Waste Containment Sites**. The system includes sensors deployed within or adjacent to a hazardous waste containment barrier to monitor the structural integrity of the containment barrier or leakage of contaminants such as radiation or volatile organic compounds from a buried waste containment site.

A technology titled **Grinding Assembly, Grinding Apparatus, Weld Joint Defect Repair System, and Methods** is credited to *Arthur Watkins, David Pace, Eric Larsen* and *Rodney Bitsoi*. This patent is for a remotely operated grinder used to remove weld defects in remote welding applications. This device is unique in that it operates automatically and can be used in hazardous environments without personnel. The grinder can be programmed to grind preselected contoured repair cavity profiles and eliminates the need for cutting fluid needed in a conventional machining operation. Repair cavities created by the device are highly accurate and can be examined by automated nondestructive examination techniques to meet welding code requirements.

A **Passively Actuated Valve** for isolating a high pressure zone from a low pressure zone is credited to *Mike Modro* and *Abderrafi Ougouag*. If the pressure in the high pressure zone drops below a preset threshold, the valve opens and allows flow from the high pressure zone to the low pressure zone. The valve remains open allowing pressure equalization and back-flow should a pressure inversion between the two pressure zones occur.

As an alternative to the established residual sodium deactivation techniques, *Steven Sherman* and *Paul Henslee* were named on a patent titled **In-situ Method for Treating Residual Sodium**. This method is a unique process for deactivating residual sodium that does not suffer from temperature and pressure instabilities and does not produce waste that requires neutralization. Unlike conventional deactivation techniques that use steam-and-nitrogen or water-saturated nitrogen to convert residual sodium metal into sodium hydroxide, this process uses humidified (but not saturated) carbon dioxide at ambient temperature and pressure to convert residual sodium into solid sodium bicarbonate.

An invention titled, **Plasma Synthesis of Lithium Based Intercalation Powders for Solid Polymer Electrolyte Batteries** resulted from the collaborative efforts of *Peter Kong, Robert Pink* and *Lee Nelson*. Increased use of portable electronics such as cellular telephones, laptop computers and PDA's over the last several years has increased the demand for compact, low cost, and environmentally friendly rechargeable batteries.